

AOP-8

8 Channel Analogue Output Board



User Manual

AOP-8

User Manual

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OUTLINE DESCRIPTION

This card provides 8 analogue outputs in the range 0-10V, at up to 10mA per channel.

1.0 SPECIFICATIONS

1.1 Electrical Specification

Number of Outputs	8
Max Output Voltage	10.24V D.C.
Max Load Current	10mA D.C.

1.2 Physical Specification

Height	107mm
Width	15mm
Depth	132mm

Electromagnetic Compatibility (EMC)

This product meets the requirements of the European EMC Directive (89/336/EEC) and is eligible to bear the CE mark.

It has been assessed operating in a Blue Chip Technology Icon industrial PC. However, because the board can be installed in a variety of computers, certain conditions have to be applied to ensure that the compatibility is maintained. It meets the requirements for an industrial environment (Class A product) subject to those conditions.

- The board must be installed in a computer system which provides screening suitable for the industrial environment.
- Any recommendations made by the computer system manufacturer/supplier must be complied with regarding earthing and the installation of boards.
- The board must be installed with the backplate securely screwed to the chassis of the computer to ensure good metal-to-metal (i.e. earth) contact.

- Most EMC problems are caused by the external cabling to the board. Analogue boards fitted with IDC ribbon cable connectors on the metal mounting bracket require particularly careful installation of the external cabling. It is imperative that any external cabling to the board is totally screened, and that the screen of the cable connects to the metal end bracket of the board and hence to earth. The cabling must be totally screened; the type of ribbon cable which is rolled to a round form with a braided wire screen is best. Standard ribbon cable will not be adequate unless it is contained wholly within the cabinetry housing the industrial PC. Keep the unscreened section as short as possible. The mounting bracket of the board includes a captive nut as an screen earth point. Connect the screen of the cable to this by the shortest possible wire.
- If difficulty with interference is experienced the cable should also be fitted with a ferrite clamp as close possible to the connector. The preferred type is the Chomerics clip-on style, type H8FE-1004-AS.
- It is recommended that cables are kept as short as possible, particularly when dealing with low level signals.
- Ensure that the screen of the external cable is bonded to a good RF earth at the remote end of the cable.

Failure to observe these recommendations may invalidate the EMC compliance.

Warning

This is a Class A product. In a domestic environment this product may cause radio interference in which case the user may be required to take adequate measures.

EMC Specification

A Blue Chip Technology Icon industrial PC fitted with this card meets the following specification:

Emissions	EN 55022:1995	
	Radiated	Class A
	Conducted	Class A & B
Immunity	EN 50082-1:1992 incorporating:	
	Electrostatic Discharge	IEC 801-2:1984 Performance Criteria B
	Radio Frequency Susceptibility	IEC 801-3:1984 Performance Criteria A
	Fast Burst Transients	IEC 801-4:1988 Performance Criteria B

2.0 USER ADJUSTMENTS

2.1 Selecting the Base Address

The board may be located in any 62 pin slot in the PC motherboard but must be set up to appear at a specified position (or 'address') in the port map. Available positions are shown in the IBM-PC Technical Reference Guide. However, for those who do not possess a copy of this document a good place is the location normally allocated to the prototyping card as supplied by IBM. This address is 300 Hex or 768 decimal.

All Blue Chip Technology cards are preset to this address at the factory.

However, no two devices should be used while set to the same address since contention will occur and neither board will work. If your machine contains a card with conflicting address then another reasonably safe address is 200 to 21F (Hex).

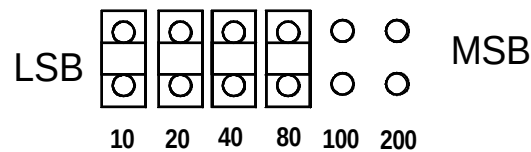
A set of links is provided on the board to set the base address of the board within the IBM-PC port map. The address is in binary with the presence of a link representing a 0 and the absence of a link representing a 1.

To set the base address to 768 Decimal (300 Hex) set the following pattern on the links as indicated:

Figure 1 - Selecting the Base Address

Note: View board with back panel on RHS.

Middle 6 Bits of port address on links.



More example addresses are shown in Appendix A.

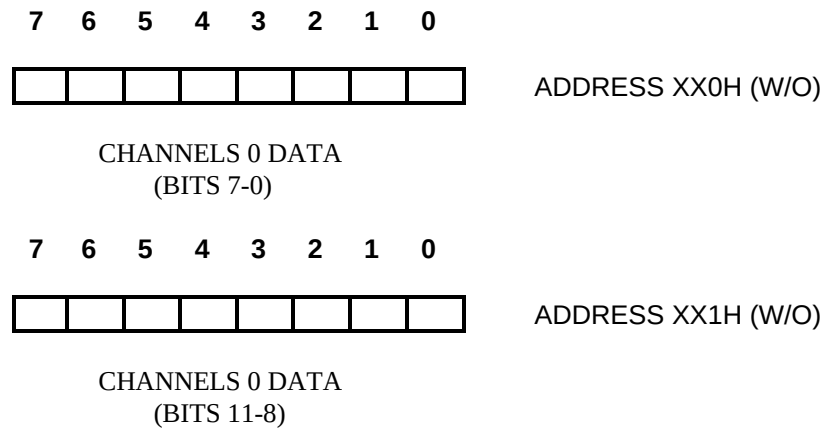
Note: No two cards must occupy the same address.

2.2 Port Map

The AOP card has up to eight 12 bit analogue output channels. These are arranged as up to eight pairs of 8 bit ports. One port holds the 8 low bits and the other the 4 high bits of the desired 12 bit output value. This is shown below:

Address	Write	Read
Base + 0	Channel 0 low 8 bits	N/A
Base + 1	Channel 0 high 4 bits	N/A
Base + 2	Channel 1 low 8 bits	N/A
Base + 3	Channel 1 high 4 bits	N/A
Base + 4	Channel 2 low 8 bits	N/A
Base + 5	Channel 2 high 4 bits	N/A
Base + 6	Channel 3 low 8 bits	N/A
Base + 7	Channel 3 high 4 bits	N/A
Base + 8	Channel 4 low 8 bits	N/A
Base + 9	Channel 4 high 4 bits	N/A
Base + 10	Channel 5 low 8 bits	N/A
Base + 11	Channel 5 high bits	N/A
Base + 12	Channel 6 low bits	N/A
Base + 13	Channel 6 high bits	N/A
Base + 14	Channel 7 low bits	N/A
Base + 15	Channel 7 high 4 bits	UPDATE

For AOP-2, AOP-4 and AOP-6 all channels begin at 0 e.g. AOP-2 uses Base + 0 to Base + 3 other channels are unpopulated.



3.0 ELECTRICAL OPTIONS

3.1 Output Connections

A 50 way insulation displacement connector (IDC) is provided on the PC rear panel of the board for output signal connection. If access to individual channels is required, a 50 way IDC ribbon cable may be used to connect the outputs to a 50 way screw terminal block available from Blue Chip Technology as part number ST-24.

The functions of the pins are shown in Section 3.2.

When the connector is viewed from the back of the system, odd numbered pins are on the left and even numbered pins are on the right with pin 1 at the top of the connector.

Pin Detail

Pin	1	O	O	Pin	2
Pin	3	O	O	Pin	4
O		O	O	.	
.		O	O	.	
.				.	
.				.	
.				.	
.		O	O	.	
.		O	O	.	
Pin	47	O	O	Pin	48
Pin	49	O	O	Pin	50

View with gold edge connectors downwards.

3.2 Connector Pin Details

Function	Pin	Pin	Function
Channel 0 + ve	1 o	o 2	Analogue Ground
Channel 1 + ve	3 o	o 4	Analogue Ground
Channel 2 + ve	5 o	o 6	Analogue Ground
Channel 3 + ve	7 o	o 8	Analogue Ground
Channel 4 + ve	9 o	o 10	Analogue Ground
Channel 5 + ve	11 o	o 12	Analogue Ground
Channel 6 + ve	13 o	o 14	Analogue Ground
Channel 7 + ve	15 o	o 16	Analogue Ground
Analogue Ground	17 o	o 18	Analogue Ground
Analogue Ground	19 o	o 20	Analogue Ground
Analogue Ground	21 o	o 22	Analogue Ground
Analogue Ground	23 o	o 24	Analogue Ground
Analogue Ground	25 o	o 26	Analogue Ground
Analogue Ground	27 o	o 28	Analogue Ground
Analogue Ground	29 o	o 30	Analogue Ground
Analogue Ground	31 o	o 32	Analogue Ground
Analogue Ground	33 o	o 34	Analogue Ground
Analogue Ground	35 o	o 36	Analogue Ground
Analogue Ground	37 o	o 38	Analogue Ground
Analogue Ground	39 o	o 40	Analogue Ground
Analogue Ground	41 o	o 42	Analogue Ground
Analogue Ground	43 o	o 44 6	Analogue Ground
Analogue Ground	45 o	o 46	Analogue Ground
Analogue Ground	47 o	o 48	Analogue Ground
0V	49 o	o 50	0V

4.0 OPERATING GUIDE

4.1 Using the Device

The normal method of setting an output is:

1. Load data by writing to low byte port.
2. Load data on writing to high NIBL port.
3. Strobe data to output by reading UPDATE port.

The digital to analogue converters used on this board contain a buffer and the data is initially written into this buffer without changing the output voltage. The output voltages are not altered until the UPDATE command is performed which transfers the data from all buffers to their respective output register without altering the data in the buffers. Thus single channels may be updated using an UPDATE command immediately after loading data for one channel, or several output signals may be changed simultaneously by first loading data into the relevant buffers and then issuing the UPDATE command.

The procedure for a single output is illustrated in the software example.

4.2 Programming Guide

The output signals may be set as shown in the following example using Microsoft BASIC A or GW BASIC:

```

10      INPUT  "Enter voltage required":V
20      BITS  = V*400
30      TOP   = INT(BITS/256)
40      BOT   = INT (BITS-256*TOP)
50      OUT    &H300,BOT           'Set bottom byte
60      OUT    &H301, TOP          'Set top NIBL
70      A      = INP (&H30F)
```

This example assumes a standard board set for 2.5mV/bit or 0-10.24V output and sets only channel 0 as controlled by the 'OUT' statements in lines 50 and 60.

4.3 User Options

a. Grounding

The analogue ground for the outputs can be linked to digital ground using a link option (LKB). When the link is fitted the two grounds are connected. Conversely with the link removed the grounds are allowed to float at different voltages up to +/- 0.6V under the clamping action of diodes D2 and D3.

b. Calibration

A 10V reference is generated for all channels from diode D1 and IC5. This voltage may be trimmed using RV5 or completely re-scaled by changing R1, R2 or D1. Individual channels can be trimmed by trimpots as follows:

Channel	Trimpot Ref.
0	RV2
1	RV1
2	RV7
3	RV6
4	RV4
5	RV3
6	RV9
7	RV8

5.0 COMMERCIAL DATA ACQUISITION PACKAGES

The Blue Chip Technology DOP-24 can be used with almost any data acquisition or control package that can write information directly to a PC output port.

5.1 Use of the AOP-8 Board with ASYST

The board has been tested with and is installable as an IO.PORT digital device in the ASYST scientific software package by Macmillan Software Company.

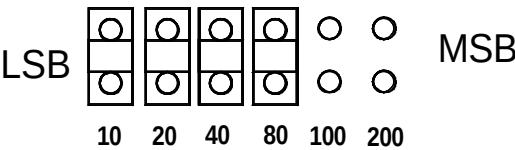
For more details about this package and other PC data acquisition software, please contact Blue Chip Technology.

Whilst every effort has been taken to ensure that the information provided is accurate, Blue Chip Technology cannot assume responsibility for any errors in this manual or their consequences. Should any errors be detected, the company would greatly appreciate being informed of them. A policy of continuous product development is operated, resulting in the contents of this document being subject to change without notice.

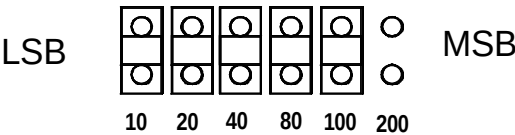
APPENDIX A

Note view board with back panel on RHS.

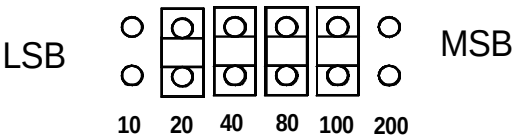
Address Settings for Port 300H



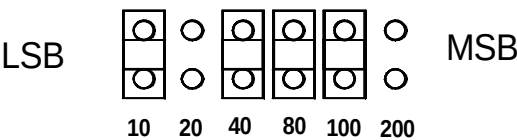
Address Settings for Port 200H



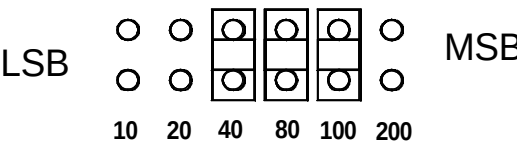
Address Settings for Port 210H



Address Settings for Port 220H



Address Settings for Port 230H



APPENDIX B - PC MAPS

PC/XT/AT I/O Address Map

<u>Address</u>	<u>Allocated to:</u>
000-01F	DMA Controller 1 (8237A-5)
020-03F	Interrupt Controller 1 (8259A)
040-05F	Timer (8254)
060-06F	Keyboard Controller (8742) Control Port B
070-07F	RTC and CMOS RAM, NMI Mask (Write)
080-09F	DMA Page Register (Memory Mapper)
0A0-0BF	Interrupt Controller 2 (8259)
0F0	Clear NPX (80287) Busy
0F1	Reset NPX (80287)
0F8-0FF	Numeric Processor Extension (80287)
1F0-1F8	Hard Disk Drive Controller
200-207	Reserved
278-27F	Reserved for Parallel Printer Port 2
2F8-2FF	Reserved for Serial Port 2
300-31F	Reserved
360-36F	Reserved
378-37F	Parallel Printer Port 1
380-38F	Reserved for SDLC Communications, Bisync 2
3A0-3AF	Reserved for Bisync 1
3B0-3BF	Reserved
3C0-3CF	Reserved
3D0-3DF	Display Controller
3F0-3F7	Diskette Drive Controller
3F8-3FF	Serial Port 1

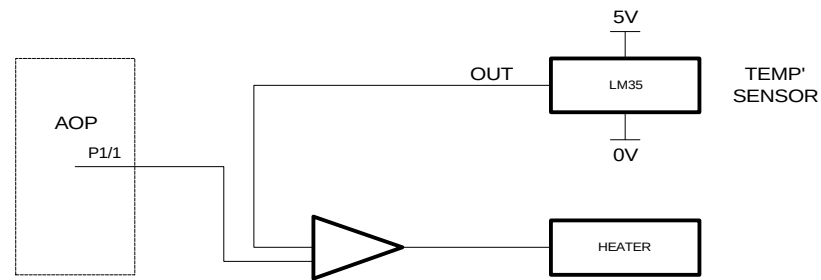
PC/XT Interrupt Map

<u>Number</u>	<u>Allocated to:</u>
NMI	Parity
0	Timer
1	Keyboard
2	Reserved
3	Asynchronous Communications (Secondary) SDLC Communications
4	Asynchronous Communications (Primary) SDLC Communications
5	Fixed Disk
6	Diskette
7	Parallel Printer

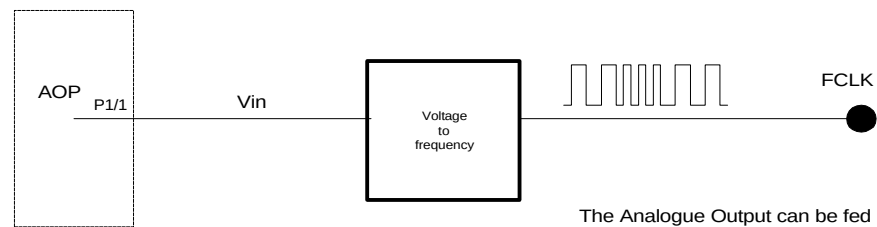
PC/AT Interrupt Map

<u>Level</u>	<u>Allocated to:</u>
CPU NMI	Parity or I/O Channel Check
CTLR 1 CTLR 2	(Interrupt Controllers)
IRQ 0	Timer Output 0
IRQ 1	Keyboard (Output Buffer Full)
IRQ 2	Interrupt from CTLR 2
	IRQ 8 Real-time Clock Interrupt
	IRQ 9 S/w Redirected to INT 0AH (IRQ 2)
	IRQ 10 Reserved
	IRQ 11 Reserved
	IRQ 12 Reserved
	IRQ 13 Co-processor
	IRQ 14 Fixed Disk Controller
	IRQ 15 Reserved
IRQ 3	Serial Port 2
IRQ 4	Serial Port 1
IRQ 5	Parallel Port 2
IRQ 6	Diskette Controller
IRQ 7	Parallel Port 1

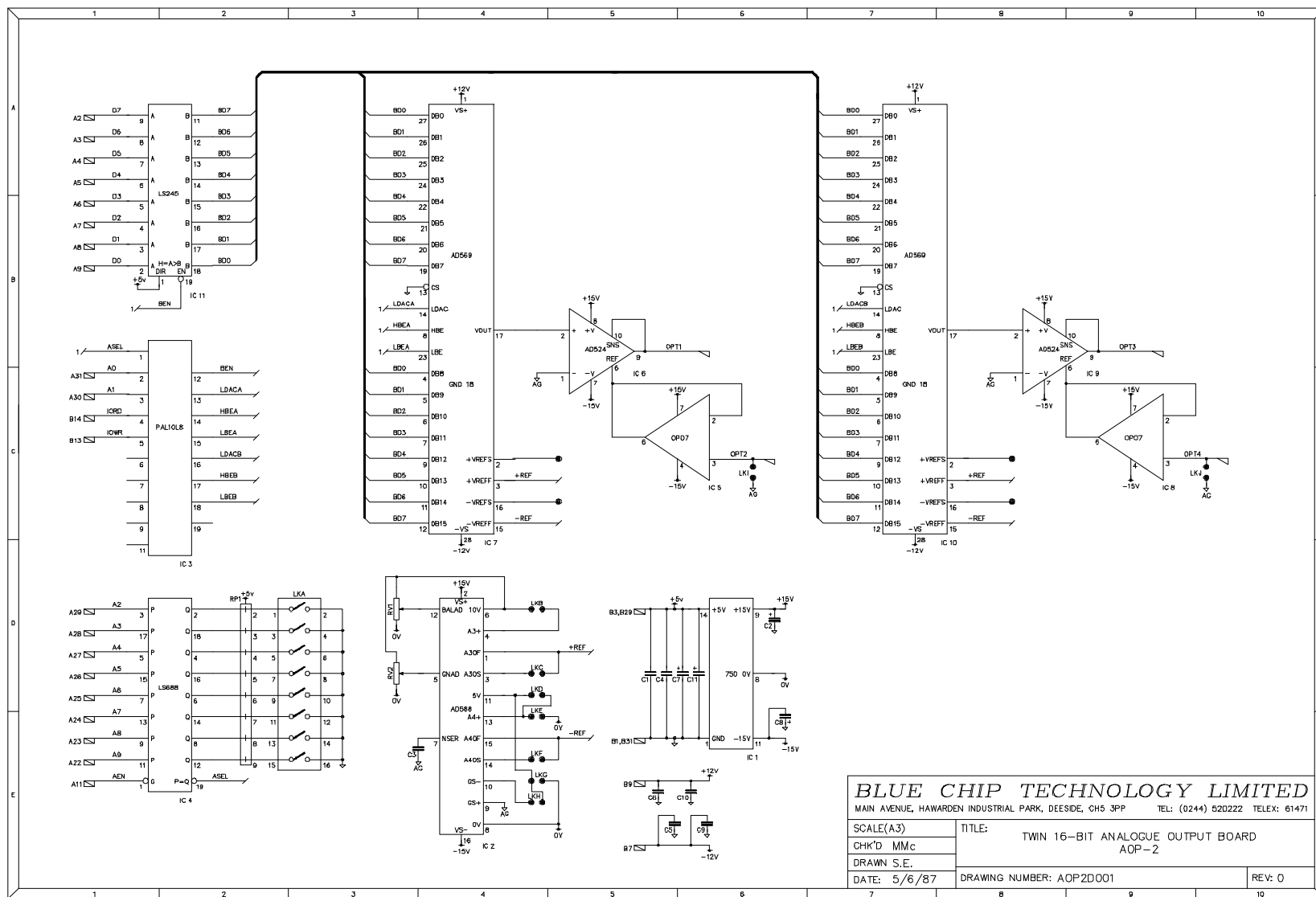
Typical Methods of Interfacing from an AOP card to other Circuitry

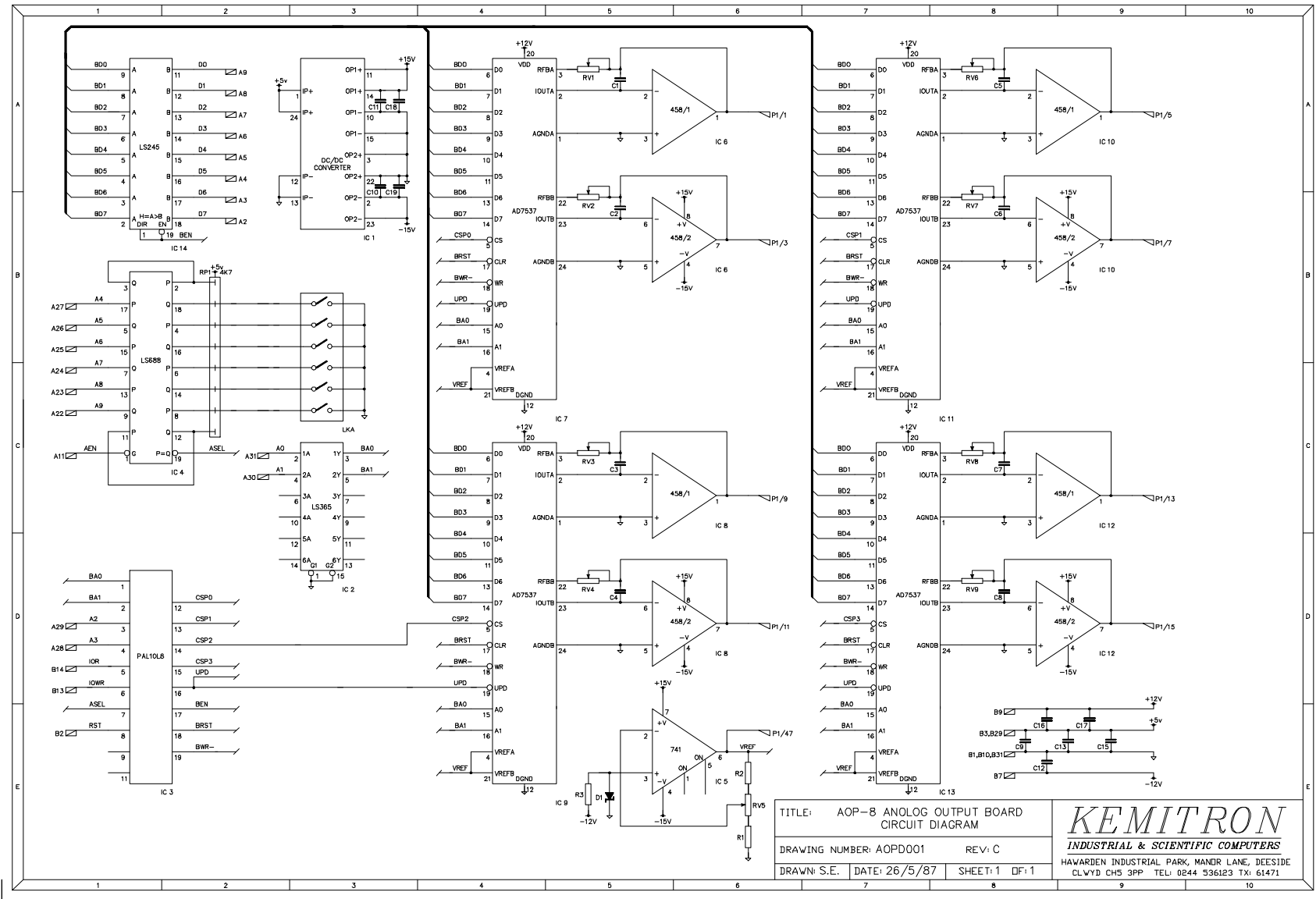


The Analogue Output card can be used as a voltage reference in a closed loop temperature monitoring circuit



The Analogue Output can be fed into a voltage to frequency converter





TITLE: AOP-8 ANALOG OUTPUT BOARD
CIRCUIT DIAGRAM

DRAWING NUMBER: AOPD001 REV: C

DRAWN: S.E. DATE: 26/5/87 SHEET: 1 OF 1

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